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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER AFTERGUT, JEFF H	
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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/068,857  
Filing Date: February 11, 2002  
Appellant(s): LOUBINOUX, DOMINIQUE

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Stefan Koschmieder  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed May 27, 2008 appealing from the Office action mailed August 27, 2007.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

No amendment after final has been filed.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows: Whether claims 30, 31, 44, 47, 52 and 54-59 are patentable under 35 USC 103(a) over the combination of Middelman in view of any one of O'Connor, NASA Tech Brief entitled "Solventless Fabrication of

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Reinforced Composites", U.K. Patent 2,190,041 or Curzio and optionally further taken with either one of Vane or Matsuo.

### **(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

### **(8) Evidence Relied Upon**

#### **(A) Listing of Evidence Relied Upon**

5,269,863	Middelman	12-1993
4,800,113	O'Connor	1-1989
4,539,249	Curzio	9-1985
2,190,041	Senoir (United Kingdom)	11-1987
5,445,693	Vane	8-1995
5,989,710	Matsuo et al	11-1999

NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites" dated Fall 1982.

#### **(B) Brief Description of Evidence Relied Upon**

**Middelman** suggested that it was known to form the specified process for manufacturing a composite sheet including the lay up of the first fiber bundle and placing a lap of threads upon the moving bundle of threads followed by combining this first combination of threads with a second bundle of threads which are parallel to the first bundle of threads and all layers are separate and unconnected. The reference

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taught that the assembly was impregnated with thermoplastic resin to form the composite sheet and employed a metering device 15 to add the resin to the fiber layers. The finished assembly was subjected to heat and pressure after impregnation. The reference failed to expressly state that one skilled in the art would have employed a thermoplastic matrix filament as part of the second combination of threads in order to facilitate impregnation with the thermoplastic resin.

The references to any one of **NASA Tech Brief**, **Curzio**, **O'Connor**, or **U.K. '041** all suggested that one skilled in the art of composite manufacture with a thermoplastic matrix resin used with reinforcing fibers would have applied the thermoplastic matrix via a thermoplastic matrix fiber which was incorporated within the reinforcing fabric and melted to provide the matrix in the composite article as the use of such a matrix fiber material had advantages over impregnation from solution or hot melt.

The references to either one of **Vane** or **Matsuo** suggested that it was known at the time the invention was made to employ a thermoplastic matrix filament (which supplied the matrix for the composite) and a reinforcing filament together in the manufacture of a multilayer multidirectional composite fabric manufacture.

### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 30, 31, 44, 47, 52, and 54-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Middelman (US Patent 5,269,863) in view of any one of O'Connor (U.S. Patent 4,800,113) , NASA Tech Brief entitled "Solventless Fabrication

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of Reinforced Composites” , U.K. Patent 2,190,041 or Curzio (U.S. Patent 4,539,249) and optionally further taken with either one of Vane (US Patent 5,445,693) or Matsuo et al (US Patent 5,989,710).

Middelman suggested that it was known at the time the invention was made to form a composite sheet which included the steps of providing a first bundle of parallel threads moving unidirectionally in a first direction, placing a lap of threads on the surface of the moving bundle of threads with a weft insertion carriage (unit 8) in a single layer of continuous threads (see Figures 2, 4, and 6 and note column 3, lines 36-39, column 10, lines 3-6) which are oriented in a second direction transverse to the first direction to provide a combination of threads having a first layer comprising the moving bundle of threads and a second layer comprising the lap of threads. A second bundle of parallel threads moving in direction transverse to the first bundle of threads is applied to the opposite side of the first bundle of threads from the single layer of the lap of threads to provide in the following order a first layer of moving threads, a second layer of a lap of threads and a third layer of a second bundle of threads wherein the layers of threads are separate and unconnected from one another. Subsequent to forming the specified fiber arrangement, the reference to Middelman suggested that those skilled in the art would have impregnated the fiber assembly with a thermoplastic resin matrix material with a metering device 15 subsequent to formation of the fiber assembly, see column 4, lines 33-40, column 8, lines 39-47. It being noted that the specifics of the metering device are not described other than to recite it as a metering device (i.e. it is a black box where the impregnation of the threads takes place, but the specific means used for

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impregnation are of little import in Middelman). The reference taught that one skilled in the art would have subjected the impregnated laminate to a heating operation with pressure followed by allowing the assembly to cool, see column 8, lines 47-66. The reference taught that the fibers useful for the laminate included not only reinforcing fibers but also thermoplastic fibers, see column 4, lines 33-46. The reference also suggested that those skilled in the art would have formed the laminate from solely the first bundle of parallel threads, the lap of threads and the second bundle of parallel threads. The reference failed to expressly state that one skilled in the art would have avoided the use of the metering device for impregnation with the matrix material and instead employed a thermoplastic fiber with a lower melting point than a reinforcing fiber as the means for impregnation wherein the mixed fiber arrangement was used in the layers which made up the assembly (note as addressed above that the metering device is more or less depicted and described as a "black box" where the impregnation of the fiber lay up takes place and no specific devices for the impregnation operation are described in Middelman).

However, rather than impregnation with a solvent or a melt of a thermoplastic (which is the conventional manner typically used to impregnate with thermoplastic resin with a metering device like that of Middelman), it was known at the time the invention was made to employ a blend of commingled fibers of thermoplastic low melting point material and reinforcing filaments together to form a composite article whereby subsequent to a heat treatment the thermoplastic filaments formed a matrix for the assembly in the composite article as taught by O'Connor, NASA Tech Brief, U.K. '041 or

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Curzio. More specifically, O'Connor NASA Tech Brief, U.K. '041 and Curzio suggested that it was known to form a composite article via an operation wherein the matrix material was introduced via a coating operation either as a melt of thermoplastic or a wet operation via a solvent coating operation. Each reference suggested that such processing was disadvantageous in that the finished end product was stiff and difficult to handle in subsequent shaping operation as well as the problems associated with the impregnation itself which included solvent exposure as well as the cost associated with melting the thermoplastic materials. Each reference suggested that as an alternative one skilled in the art at the time the invention was made would have incorporated a thermoplastic filament with the reinforcing filament and contacted the same such as by commingling the fibers together whereby the hybrid blend of fibers was then processed into a composite after formation into a fabric material by laying, braiding, knitting and/or weaving (which appears to include non-woven manufacture). As it would have improved the handling of the composite material into an article during fabrication and as it would have eliminated the problems associated with melt impregnation as well as solvent impregnation of the reinforcing fibers with the thermoplastic, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ a thermoplastic fiber with a reinforcing fiber in the formation of a thermoplastic fiber reinforced composite wherein the thermoplastic fiber provided the matrix material for the composite article as suggested by any one of O'Connor, NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio in the process of making a composite board as suggested by Middelmann. It should



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additionally be noted that the inclusion of the thermoplastic matrix fiber with the reinforcing fiber in Middelman would not have excluded the impregnation device 15, rather the impregnation device would have been the application of heat and pressure to melt the matrix material (the thermoplastic fiber in the composite lay up) and the use of the thermoplastic fiber in the operation would have merely eliminated the introduction of the thermoplastic to the reinforcing fibers in the form of a solution with solvent or as a melt.

With respect to claim 31, note that the reference to Middelman suggested that one skilled in the art at the time the invention was made could apply additional layers of material to provide additional reinforcement (i.e. make a 5 layer assembly rather than a 3 layer assembly) and additionally applied copper foil onto the assembly in order to make a circuit board therein. Regarding claim 44, note that the reference to Middelman suggested that one skilled in the art would have applied heat and pressure to the assembly with a double band press. Additionally, note that the references to any one of O'Connor, NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio suggested that those skilled in the art would have applied heat and pressure as well as a subsequent cooling of the assembly when infiltrating the reinforcing fibers with the thermoplastic in the form of a fiber in the composite. Regarding claim 47, note that Middelman suggested that threads of organic material would have been suitable as the reinforcing fibers for the processing in the manufacture of the composite. Regarding claim 52, note that the references suggested that glass fibers would have been useful as the reinforcing fibers and that polypropylene

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would have been useful for the plastic fibers therein. Regarding claim 54, note that Middelman suggested that the fibers were continuous in the processing. Regarding claim 55, note that the references to any one of O'Connor, NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio suggested that one skilled in the art would have employed 40-80 percent reinforcing material in the composites formed according the processing therein. Regarding claims 56 and 57, note that Middelman suggested that the thickness of the finished sheet assembly would have been approximately 1.6 mm, see column 10, lines 38-42.

While it would have been obvious as expressed above to employ the thermoplastic in the form of a filament which was intermixed with the reinforcing fiber and then formed into the laid up fabric rather than impregnation of the fabric with the resin, the prior art did not expressly suggest that one would have known that the commingled fibers would have been suitable for lay down in the formation of a multilaxial fabric arrangement. However, such was well recognized in the art as a useful fabric forming technique in composite manufacture wherein one employed thermoplastic filaments and reinforcing filaments wherein the thermoplastic filaments made up part of the matrix in the finished assembly as suggested by Vane and Matsuo et al. either one of Vane or Matsuo et al suggested that those skilled in the art at the time the invention was made would have known to mix thermoplastic fibers and reinforcing fibers and to form the same into multi layer multi direction reinforced composite article by laying the blended fiber material at various angles within various layers to make a composite material. It would have been understood that the commingled fibers of any one of

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O'Connor , NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio would have been capable of processing in the manner described by Middelman for forming a multilayer multiaxially reinforced composite material as the references to either one of Vane or Matsuo et al suggested such processing. It would have been obvious to one of ordinary skill in the art at the time the invention was made to employ a thermoplastic fiber with a reinforcing fiber in the formation of a thermoplastic fiber reinforced composite wherein the thermoplastic fiber provided the matrix material for the composite article as suggested by any one of O'Connor , NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio in the process of making a composite board as suggested by Middelman wherein one skilled in the art would have understood that the reinforcing fiber and thermoplastic fiber mixtures would have been suitable for fabric formation in accordance with the processing of Middelman as evidenced by Vane or Matsuo et al.

#### **(10) Response to Argument**

The appellant essentially has a single argument for patentability of the claimed invention. The appellant takes the position that Middelman includes a step of introducing a thermoplastic matrix material for the bundles of threads via an impregnating step (with metering device 15) which is contrary to the claimed invention wherein the invention formed the composite material solely from the first and second bundles of threads and the lap of threads and that modification of Middelman to exclude

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the impregnating step would have been tantamount to changing the principles of operation of the Middelman reference (wherein the method appellant asserts is mutually exclusive of Middelman's operation). This has not been found to be persuasive. It should initially be noted that the rationale for making the combination need not be inferred or expressly hinted at or derived in the four corners of Middelman. TO the contrary, motivation for making the combination can be derived from other teachings found in the art. When one views the prior art when taken as a whole, there is simply no reason to believe one skilled in the art would have found impregnation with the metering device or impregnation with a thermoplastic thread to be mutually exclusive of one another, rather one would have understood the advantages and disadvantages of both types of processing and selected an impregnation operation accordingly. The references to any one of O'Connor, NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio clearly suggested that there was an advantage to employing a thermoplastic fiber in the lap of fibers used to make the composite as the use of the same in the operation would have eliminated the need for solvent, solution impregnation with a thermoplastic as well as hot melt impregnation with a thermoplastic resin in making the composite article therein. By eliminating the impregnation operation (metering device 15 of Middelman), one would have avoided the hazards of solvents, the voids associated with solvent impregnation, and the costs associated with heating the melt to impregnate the reinforcement with a melt. Clearly, the references to any one of O'Connor, NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio

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expressly state that the use of a thermoplastic matrix fiber with the reinforcing fiber in the composite would have had not only merit for impregnating the reinforcement but also advantages over liquid impregnation with the thermoplastic. As Middelman does not express any particular means for impregnation of the material (other than the black box of the metering device 15), one skilled in the art would have clearly understood that the specific manner of impregnation was not of patentable import in Middelman as any convenient manner useful for impregnating the reinforcing fibers therein would have been suitable for the operation. Not only would have the inclusion of thermoplastic fibers with the reinforcing fibers been viewed as an alternative to the use of a metering device for impregnation with a liquid thermoplastic resin (in the black box of Middelman), but as discussed above there were distinct advantages to not using a liquid thermoplastic resin in the impregnation operation which would have been achieved with the use of thermoplastic matrix filaments within the reinforcing fiber lay up. One cannot show non-obviousness by attacking references individually where combinations of references have been applied. It should be noted that the appellant failed to address any of the teachings of O'Connor, NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio and it is therefore deemed that appellant is in agreement with the Office interpretation of these references. Additionally, while these references did not expressly employ the thermoplastic matrix fiber with the reinforcing fiber in a multiaxial, multilayer fabric, the references to either one of Vane or Matsuo et al clearly evidenced that the use of a thermoplastic matrix fiber in a multiaxial, multilayer assembly was known at the time the invention was made. Appellant's

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argument that one would not have used the matrix, thermoplastic fibers in the fiber arrangement (and excluded the metering device of Middelman in the operation therein) has not been found persuasive as the processing with such a thermoplastic matrix fiber was not only known per se in composite manufacture but was additionally recognized as useful in multilayer, multiaxial fabric assemblies for provision of the matrix therein as suggested by Vane or Matsuo et al. Appellant again has not addressed the references to Vane or Matsuo et al and it is therefore deemed is in agreement with the Office interpretation of these references. As the artisan when viewing the prior art as a whole would have been motivated to utilize thermoplastic matrix fibers with the glass reinforcing fibers in Middelman as an alternative to the black box metering (impregnating) described therein for the reasons identified above regarding the references to O'Connor, NASA Tech Brief entitled "Solventless Fabrication of Reinforced Composites", U.K. Patent 2,190,041 or Curzio wherein impregnation with a thermoplastic filament in a multiaxial, multidirectional, multilayer composite material was known per se as evidenced by Matsuo et al or Vane, it is believed that the prima facie case should be sustained. Appellant's argument as to the criticality of the use of the metering device in Middelman for manufacturing a printed circuit board has not been found to be persuasive for the reasons discussed above.

#### **(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

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For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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